

1. Introduction

Background

The principal focus of this report is to provide accurate annual estimates of U.S. proved reserves of crude oil, natural gas, and natural gas liquids. These estimates are essential to the development, implementation, and evaluation of national energy policy and legislation. In the past, the Government and the public relied upon industry estimates of proved reserves. However, the industry ceased publication of reserve estimates after its 1979 report.

In response to a recognized need for credible annual proved reserves estimates, Congress, in 1977, required the Department of Energy to prepare such estimates. To meet this requirement, the Energy Information Administration (EIA) developed a program that established a unified, verifiable, comprehensive, and continuing annual statistical series for proved reserves of crude oil and natural gas. It was expanded to include proved reserves of natural gas liquids for the 1979 and subsequent reports.

Survey Overview

EIA defines proved reserves, the major topic of this report, as those volumes of oil and gas that geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. There are other categories of reserves, but by definition they are more speculative and less precise than proved reserves. Readers who are unfamiliar with the distinctions between types of reserves or with how reserves fit in the description of overall oil and gas resources should see Appendix G.

While the primary topic of this report is proved reserves, information is also presented on indicated additional crude oil reserves. Indicated additional crude oil reserves are not included in proved reserves because of their uncertain economic recoverability. When economic recoverability is demonstrated, these volumes will be reclassified and transferred to the proved reserves category as positive revisions.

This report provides proved reserves estimates for calendar year 1998. It is based on data filed by large operators of oil and gas wells on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," and by operators of all natural gas processing plants on Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production." The U.S. crude oil and natural gas proved reserves estimates are associated with sampling errors of less than 1 percent at a 95-percent confidence level.

Form EIA-23

On Form EIA-23, an operator is defined as an organization or person responsible for the management and day-to-day operation of oil and/or gas wells. This definition eliminates responses from royalty owners, working interest owners (unless they are also operators), and others not directly responsible for oil and gas production operations.

Operator size categories are based upon their annual production as indicated in various Federal, State, and commercial records. Large operators are those that produced at least 1.5 million barrels of crude oil or 15 billion cubic feet of natural gas, or both, during the report year. Intermediate operators produced less than large operators, but more than 400,000 barrels of crude oil or 2 billion cubic feet of natural gas, or both. Small operators are those that produced less than intermediate operators. All data are reported on a total operated basis, encompassing all proved reserves and production associated with wells operated by an individual operator. This concept is also called the "gross operated" or "8/8ths" basis.

Large operators and most intermediate size operators report reserves balance data on Form EIA-23 to show how and why reserves components changed during the year on a field-by-field basis. Intermediate size operators who do not keep reserves data were not asked to provide estimates of reserves at the beginning of the year or annual changes to proved reserves by component of change; i.e., revisions, extensions, and new discoveries. These volumes were estimated by applying an algebraic allocation scheme that preserved the relative relationships between these items within each State or State subdivision, as reported by large and intermediate operators.

The published reserve estimates include an additional term, adjustments, calculated by the EIA, that preserves an exact annual reserves balance of the form:

Published Proved Reserves at End of Previous Report Year
+ Adjustments
+ Revision Increases
– Revision Decreases
+ Extensions
+ New Field Discoveries
+ New Reservoir Discoveries in Old Fields
– Report Year Production
= Published Proved Reserves at End of Report Year

Adjustments are the annual changes in the published reserve estimates that cannot be attributed to the estimates for other reserve change categories. They result from the survey and statistical estimation methods employed. For example, variations caused by changes in the operator frame, different random samples, changes in reserve estimates following ownership changes, incorrectly reported data, or imputations for missing or unreported reserve changes can contribute to adjustments.

Form EIA-64A

Form EIA-64A data were first collected for the 1979 survey year in order to develop estimates for total natural gas liquids reserves. Data on liquids recovered from natural gas, as reported by natural gas processing plant operators, are combined with lease condensate data collected on Form EIA-23 to provide the total natural gas liquids reserves estimates.

Data Collection Operations

An intensive effort is made each year to maintain an accurate and complete survey frame consisting of operators of oil and gas wells and of natural gas processing plants. The Form EIA-23 operator frame contained 23,620 probable active operators and the Form EIA-64A plant frame contained 621 probable active natural gas processing plants in the United States when the 1998 surveys were initiated. As usual, additional operators were added to the survey as it

progressed, and many operators initially in the sample frame were found to be inactive in 1998.

For the report year 1998, EIA mailed 598 EIA-23 forms to all known large and intermediate size oil and gas well operators that were believed to be active during 1998. Of these, 26 were found to be nonoperators that did not have successor operators in 1998. Data were received from 588 operators, an overall response rate of 100 percent of the active operators in the Form EIA-23 survey. EIA mailed 621 EIA-64A forms to natural gas processing plant operators. More than one form is received for a plant that has more than one operator during the year. Forms were received from 100 percent of the operators of the 605 unique active natural gas processing plants in the Form EIA-64A survey.

National estimates of the production volumes for crude oil, lease condensate, natural gas liquids, and dry natural gas based on Form EIA-23 and Form EIA-64A were compared with corresponding official production volumes published by EIA, which are obtained from non-survey based State sources. For report year 1998, the Form EIA-23 National production estimates were 5 percent lower than the comparable *Petroleum Supply Annual (PSA) 1998* volumes for crude oil and lease condensate combined, and were 0.5 percent lower than the comparable *Natural Gas Annual 1998* volume for 1998 dry natural gas. For report year 1998, the Form EIA-64A National estimates were 8 percent lower than the *PSA 1998* volume for natural gas plant liquids production.

Accuracy in reserves reporting is EIA's first and foremost goal for this report. Estimates of production within this report may be lower than those made specifically to estimate oil or gas production like those in the *PSA*. There were over a thousand significant oil and gas field sales in 1998 reviewed by EIA as part of our quality assurance program. Often, new operators of a field acquired through purchase correctly reported their new proved reserves on Form EIA-23, but then reported only their 1998 production since assuming ownership – which may leave out several months of production from their reported annual total for a field. The net effect of this was a larger than usual difference between the total oil production reported on Form EIA-23 and the annual production reported in the *PSA 1998*.